Gender Differences In Reaction To Enforcement Mechanisms: A Large-Scale Natural Field Experiment

Zhengyang Bao
Monash University

Difang Huang
University of Hong Kong

Financing Women-led SMEs Research Conference

Background

- Men and women have some fundamental differences in their preferences and behaviors.
  - Women tend to be more risk-averse, less likely to enter competitive environments, and respond to social and financial incentives differently from men (e.g., Andreoni and Vesterlund, 2001; Gneezy and Rustichini, 2004).

- Men and women may react differently to some enforcement mechanisms.

Research Question

- In this paper, we fill this gap by conducting a natural field experiment investigating potential gender differences in response to enforcement mechanisms that are commonly employed in economic and financial contexts.

- In particular, we consider enforcement mechanisms based on social and financial incentives and test them on borrowers from one of the largest FinTech lending platforms in China.

Overview

- In the experiment, male and female borrowers are randomized into one of the treatment groups and receive text messages from the platform asking them to repay on time.

- All treatments successfully reduce the overdue rate for both male and female borrowers.

- The most effective mechanism to encourage female borrowers to repay loans on time is the social pressure from notifying the endorsers.

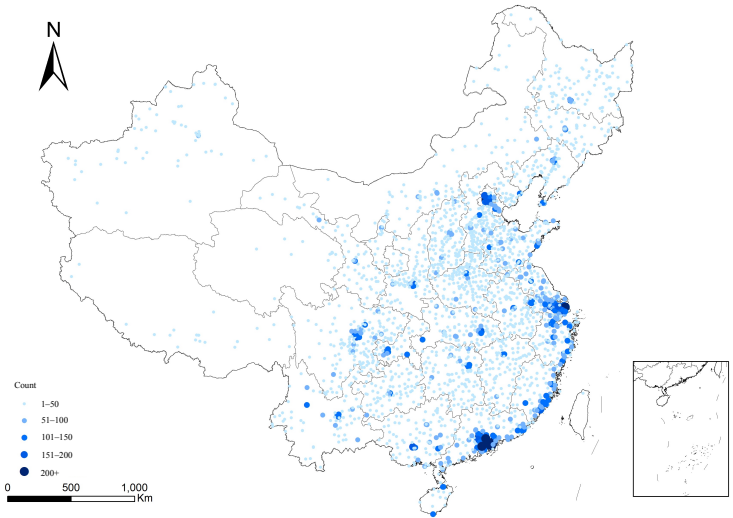
- The most effective mechanism for their male counterparts is the threat of financial punishment.

Experimental Design

Experimental Design: FinTech lending platform

- We conduct the experiment with one of the largest FinTech lending platform in China.
- The FinTech lending platform collects funds from lenders and provides a loan facility to borrowers, similar to a financial intermediary.
- 65.4 M active users ($\approx$ 7 times population in London) in China and a transaction volume of CNY 17.6 B (USD 2.63 B) in 2017.
- We focus on the borrowers who take **credit loans** with the principal and interest paid at maturity.

Male Borrowers



Female Borrowers

Why FinTech lending platform?

- The FinTech industry is less regulated in China.
- The platform provides highly reliable users' information (i.e., gender).
- Non-compliance (overdue) rate is relatively gender-neutral.
- Overdue behavior is easily identifiable, minimizing the bias caused by measurement errors.
- The platform provides a large sample size with a moderate overdue rate.

Experimental Design: FinTech lending

How to borrow money from the platform?

- Register with personal information + **five** endorsers (friend and/or family member).
- Submit an application to borrow money (amount and maturity).
- Negotiate an interest with the FinTech platform.
- Investors receive information about the application and decide whether to invest.
- Successfully receive the money if any investor decide to invest.

Experimental Design: FinTech lending

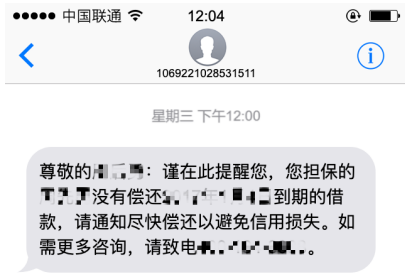
FinTech lending regulation:

- Interest is accumulated on a daily basis.
- Principal and interest must be paid back in full to the platform before the due date.
- No partial repayment was allowed.
- If the loan is overdue, then a daily penalty applies.
- If the loan is more than 29 days overdue, then the loan is considered a default.
- Cannot borrow a second loan without repaying the first one.

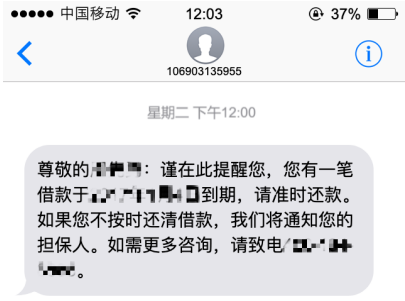
Experimental Design: Treatments

- **Baseline** (n=3768: 1585 females and 2183 males): no message was sent.
- **Reminder** (n=2823: 1165 females and 1658 males): a simple reminder message was sent asking the participant to repay on time.
- **Norm** (n=2807: 1166 females and 1641 males): a message stated that most borrowers made their repayment on time and asked the participant to do the same.
- **Shame** (n=2789: 1161 females and 1628 males): a message stated that her/his endorsers would be notified if the participant did not make the repayment on time.
- **Reward** (n=2815: 1172 females and 1643 males): a message to reduce the interest rate for the future loan if the participant makes the repayment on time.
- **Punish** (n=2543: 1022 females and 1521 males): a message to increase the interest rate for the future loan if the participant fails to make the repayment on time.

Reminder Treatment



Punish Treatment



Experimental Design: Experimental Procedures

- The experiment was conducted between January 2017 and March 2017.
- We recruit borrowers who:
  - have no overdue record;
  - have not participated in the experiment before;
  - have a loan due **next day**.
- In practice, on 1st January 2017, we identified 58,345 borrowers with no overdue record and due dates between 2nd January and 31st March.
- In total, 17,545 borrowers participated. Each participant was randomized into one treatment and receive the corresponding text message and incentives.

Hypotheses

Hypotheses

- People suffer from limited attention (see, e.g., DellaVigna, 2009; Hirshleifer and Teoh, 2003) and are susceptible to nudges that evoke morality and pro-sociality (Allcott, 2011; Bursztyn et al., 2019).

- Specifically, social norms (Hallsworth et al., 2017) and shame (Brocas et al., 2020; Kahan and Posner, 1999) have proven to be useful in encouraging compliance in other contexts.

- Consequently, a reminder message may reduce late repayment caused by forgetfulness, while messages that induce social pressure may reduce the severity of the moral hazard as the literature suggests.

Hypotheses

- *Hypothesis 1: All of the treatments reduce the overdue rate as compared with the baseline.*

Hypotheses

- The message sent to the Shame treatment group explicitly mentioned the possibility of contacting endorsers, we anticipate the impact of the choice of endorsers to be magnified.

- If so, women borrowers should be more responsive to the Shame treatment given they nominate more family members as endorsers.

Hypotheses

- The literature finds that women tend to be more prone to shame (Ferguson et al., 2000; Lewis et al., 1992) and respond to shame more than men in other contexts such as stealing (Brocas et al., 2020).

- As a result, we predict that the Shame treatment is more effective for female borrowers as well.

Hypotheses

- For the Norm treatment, research in psychology and neuroscience shows that women are more sensitive than men to social cues determining what behavior is appropriate in certain contexts (see, e.g., Chen et al., 2019; Gilligan, 1993).

- Therefore, we hypothesize that female borrowers respond more than males to the Norm treatment as well.

Hypotheses

- *Hypothesis 2: Women respond more than men to the social incentives.*

Hypotheses

- For the financial incentives, the magnitude of the reward/punishment depends on the product of the interest rate and the expected amount of borrowings in the future by design.

- Accordingly, the deterrence impact may depend on the interest rate and expectation of future borrowing behavior.

- If we use the current loan amount to proxy borrowers' credit needs in the future, the prediction is that men are more responsive to financial incentives as the product of the two terms is greater for men.

Hypotheses

- We then turn to the psychological side and find several studies reveal that men are more sensitive to monetary losses and benefits than women (e.g., Kulich et al., 2011; Pokorny, 2008).

- In addition to gender differences in sensitivity to financial incentives, loss aversion (the phenomenon in which losses weigh more heavily than gains in decision processes) is another behavioral trait that may affect male and female borrowers differently.

- We expect Punishment to be more effective than Reward in influencing loan repayments for both genders. Besides, some studies find that men are more susceptible to loss aversion than women (Grolleau et al., 2016; Schmidt and Traub, 2002).

- As the preceding discussion suggests, both monetary and psychological arguments suggest that men are likely to respond more to the financial incentives.

Hypotheses

- *Hypothesis 3: Both genders respond more to Punishment than Reward, and men respond more to financial incentives than women.*

Results

Outcome Variable

Why we focus on the overdue rate?

- All of our treatments create incentives based on the repayment due date.
- Having a low overdue rate is crucial to the development of the platform.
- As mentioned earlier, due to the phone calls the platform made to the experimental participants who failed to repay on time, measuring the effect of incentives after the deadline may be contaminated.

Participants

Who participate the experiment?

- Out of the 58,345 borrowers we observe during the experimental phase, 19,513 (66%) male borrowers and 21,287 (75%) female borrowers repay at least one day early, with women more likely than men to repay early ($p = 0.0000$).

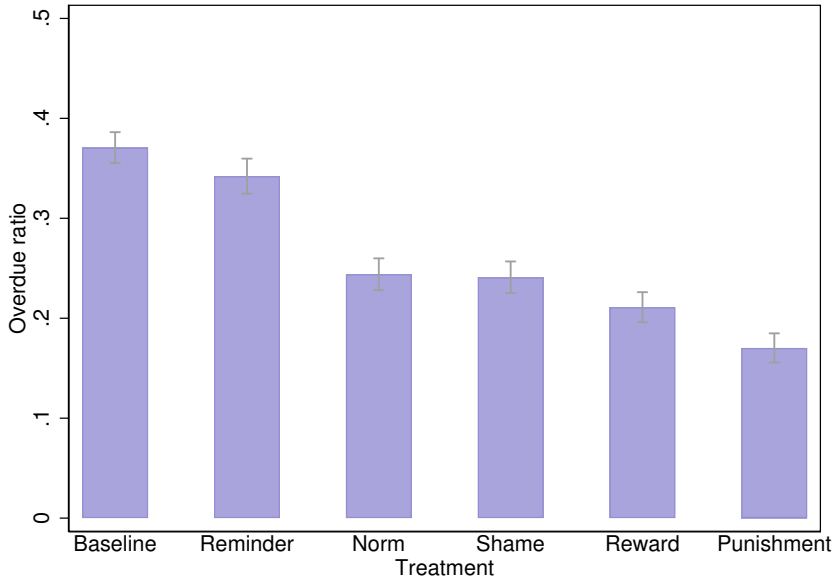
- As we send messages only one day before the deadline, those who repay earlier do not receive the experimental interventions.

- To scrutinize the gender differences caused by the enforcement mechanisms, we focus on the 17,545 who entered the experiment in the following analyses.

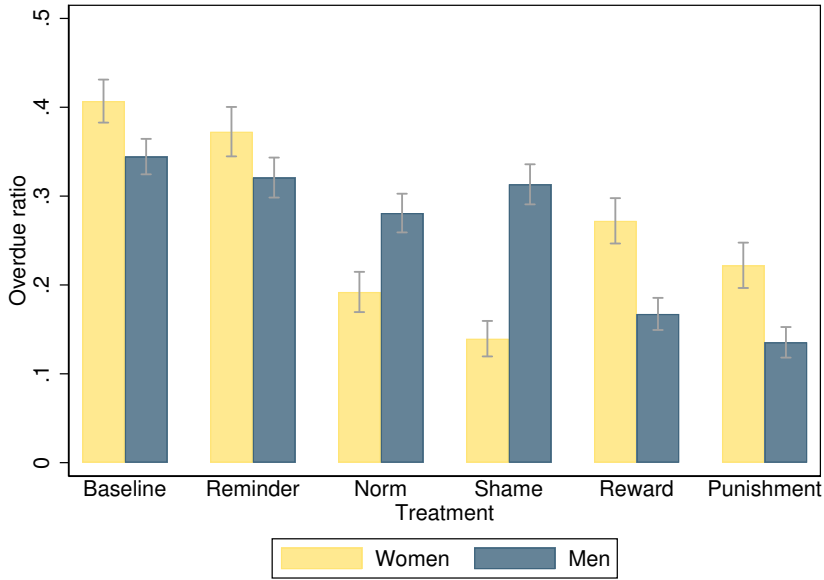
Summary Statistics

Variables	Unit	Men	Women	Difference	*p*-value
Panel A: Demographic Variables					
Age	years	28.942	28.545	0.396***	0.000
Monthly Income	RMB	4585.29	3550.96	1034.33***	0.000
Employment Indicator	0/1	0.585	0.585	0.000	0.982
High Education Indicator	0/1	0.679	0.680	-0.001	0.861
Married Indicator	0/1	0.490	0.493	-0.003	0.516
Panel B: Credit Variables					
Credit Score	1–6	2.811	2.868	-0.057***	0.000
Car Indicator	0/1	0.447	0.443	0.004	0.337
House Indicator	0/1	0.616	0.611	0.004	0.277
Other Loan Indicator	0/1	0.208	0.211	-0.003	0.331
Overdue Record Indicator	0/1	0.000	0.000	–	–
Past Borrowing Incidence	times	2.147	2.252	-0.105***	0.000
Historical Loan Amount	RMB	13690.01	13041.22	648.80	0.274
Panel C: Loan Information Variables					
Loan Amount	RMB	8502.89	7972.96	529.93***	0.000
Loan Term	months	9.669	9.242	0.426***	0.000
Interest Rate	%	16.385	16.880	-0.495***	0.000
Family Endorsers	0–5	2.215	3.148	-0.932***	0.000

Overdue Rate in Each Treatment



Gender Differences



Caveats: Control for Borrower Characteristics

$$Overdue_i = \alpha + \sum_{j \in Treatments} \sum_{k \in Genders} \beta_{j,k} \mathbb{I}\{treatment_i = j\} \cdot \mathbb{I}\{gender_i = k\} + Controls_i + \epsilon_i,$$

	Overdue Rate		
	(1)	(2)	(3)
Male baseline	-0.063***	-0.276***	-0.169***
	(-3.89)	(-3.86)	(-3.86)
Male reminder	-0.088***	-0.393***	-0.239***
	(-5.16)	(-5.12)	(-5.11)
Male norm	-0.129***	-0.595***	-0.362***
	(-7.72)	(-7.61)	(-7.64)
Male shame	-0.099***	-0.445***	-0.274***
	(-5.81)	(-5.78)	(-5.83)
Male reward	-0.242***	-1.266***	-0.748***
	(-15.44)	(-14.58)	(-14.83)
Male punish	-0.270***	-1.499***	-0.875***
	(-17.55)	(-16.00)	(-16.46)
Female reminder	-0.026	-0.107	-0.067
	(-1.42)	(-1.33)	(-1.35)
Female norm	-0.204***	-1.025***	-0.610***
	(-12.15)	(-11.23)	(-11.44)
Female shame	-0.257***	-1.415***	-0.833***
	(-16.28)	(-14.28)	(-14.88)
Female reward	-0.128***	-0.586***	-0.355***
	(-7.21)	(-6.95)	(-6.97)
Female punish	-0.182***	-0.879***	-0.528***
	(-10.26)	(-9.58)	(-9.71)

We test the null hypotheses:
The effectiveness of messages for each treatment group are the same for men and women compared with the baseline.

	Overdue Rate		
	(1)	(2)	(3)
DID reminder	$p = 0.951$	$p = 0.921$	$p = 0.961$
DID norm	$p = 0.000$	$p = 0.000$	$p = 0.000$
DID shame	$p = 0.000$	$p = 0.000$	$p = 0.000$
DID reward	$p = 0.024$	$p = 0.001$	$p = 0.001$
DID punish	$p = 0.253$	$p = 0.007$	$p = 0.016$

Caveats: Pre-existing Gender Differences

- We apply matching methods to check the robustness of the results above and further address the potential confound caused by pre-existing gender differences at the loan origination.

- We apply the propensity-score matching method, which finds for each male borrower the female borrower with the closest observed characters, and then perform the same regression analyses as before on the matched sample.

- We also report results using the entropy balancing method, which involves a re-weighting approach that provides more flexibility than propensity-score matching (Hainmueller, 2012).

	Propensity Score Matched Sample			Entropy Balanced Sample		
	(1)	(2)	(3)	(4)	(5)	(6)
Male baseline	-0.052*	-0.212*	-0.130*	-0.062***	-0.259***	-0.159***
	(-1.91)	(-1.83)	(-1.82)	(-2.98)	(-2.88)	(-2.87)
Male reminder	-0.077***	-0.331***	-0.201***	-0.087***	-0.377***	-0.230***
	(-2.79)	(-2.78)	(-2.73)	(-4.07)	(-4.01)	(-3.98)
Male norm	-0.118***	-0.535***	-0.326***	-0.129***	-0.578***	-0.353***
	(-4.32)	(-4.43)	(-4.39)	(-6.03)	(-6.05)	(-6.04)
Male shame	-0.088***	-0.382***	-0.236***	-0.098***	-0.428***	-0.265***
	(-3.17)	(-3.18)	(-3.18)	(-4.54)	(-4.51)	(-4.54)
Male reward	-0.231***	-1.206***	-0.711***	-0.241***	-1.250***	-0.739***
	(-8.60)	(-9.53)	(-9.33)	(-11.76)	(-12.16)	(-12.13)
Male punish	-0.259***	-1.438***	-0.837***	-0.270***	-1.482***	-0.865***
	(-9.73)	(-10.96)	(-10.74)	(-13.29)	(-13.66)	(-13.72)
Female reminder	-0.007	-0.022	-0.014	-0.038	-0.157	-0.098
	(-0.20)	(-0.14)	(-0.15)	(-1.39)	(-1.33)	(-1.35)
Female norm	-0.173***	-0.836***	-0.501***	-0.202***	-0.990***	-0.591***
	(-4.87)	(-4.55)	(-4.61)	(-8.28)	(-7.73)	(-7.85)
Female shame	-0.208***	-1.045***	-0.626***	-0.229***	-1.161***	-0.693***
	(-5.96)	(-5.46)	(-5.60)	(-9.00)	(-8.01)	(-8.32)
Female reward	-0.121***	-0.549***	-0.335***	-0.118***	-0.527***	-0.323***
	(-3.28)	(-3.15)	(-3.18)	(-4.48)	(-4.32)	(-4.37)
Female punish	-0.205***	-1.019***	-0.605***	-0.205***	-0.995***	-0.595***
	(-5.86)	(-5.38)	(-5.44)	(-8.40)	(-7.86)	(-7.97)

We test the null hypotheses:
The effectiveness of messages for each treatment group are the same for men and women compared with the baseline.

	Propensity Score Matched Sample			Entropy Balanced Sample		
	(1)	(2)	(3)	(4)	(5)	(6)
DID reminder	$p = 0.657$	$p = 0.575$	$p = 0.598$	$p = 0.680$	$p = 0.779$	$p = 0.743$
DID norm	$p = 0.006$	$p = 0.001$	$p = 0.009$	$p = 0.000$	$p = 0.000$	$p = 0.000$
DID shame	$p = 0.000$	$p = 0.000$	$p = 0.000$	$p = 0.000$	$p = 0.000$	$p = 0.000$
DID reward	$p = 0.139$	$p = 0.021$	$p = 0.033$	$p = 0.041$	$p = 0.001$	$p = 0.003$
DID punish	$p = 0.094$	$p = 0.032$	$p = 0.040$	$p = 0.093$	$p = 0.014$	$p = 0.021$

Caveats: Infra-Marginality in Outcome Tests

- The data finds strong evidence that, on average, women are more responsive to social pressure, while men are more sensitive to financial incentives.

- A natural question is whether borrowers' credit risk interacts with gender differences.

- To estimate an individual's credit risk, we regress the overdue dummy on all of the demographic, credit, and loan information using the 3,768 observations from the **Baseline** treatment.

$$\mathbb{E}(Overdue_i) = \Phi(0.483 - 0.256Male_i + 0.007Age_i - 0.014Income_i$$
$$- 0.215Employ_i - 0.374HighEdu_i + 0.244Married_i + 0.245Credit_i$$
$$- 0.101Car_i - 0.189House_i - 0.121OtherLoan_i - 0.008HistIncidence_i$$
$$- 0.115LoanAmount_i - 0.006LoanTerm_i - 0.007IR_i - 0.027Family_i).$$

	Male	Female	Male	Female	Male	Female
	Baseline		Reminder		Norm	
High-Risk Borrowers	0.422	0.441	0.349	0.421	0.331	0.203
Low-Risk Borrowers	0.300	0.337	0.302	0.286	0.248	0.176
	Shame		Reward		Punish	
High-Risk Borrowers	0.398	0.154	0.181	0.286	0.162	0.224
Low-Risk Borrowers	0.253	0.116	0.158	0.246	0.119	0.217

Potential Channels

Endorser and social incentives

- The strength of the Shame Treatment is conjectured to interact with the number of family members each borrower chooses as endorsers in affecting the overdue behavior.

- We examine how the choice of endorsers relates to the effectiveness of the shame message with the following approach:

$$\begin{aligned} Overdue_i = \alpha + \beta_1 \mathbb{I}\{treatment_i = Shame\} + \beta_2 MoreFamily_i \\ + \beta_3 \mathbb{I}\{treatment_i = Shame\} \cdot MoreFamily_i + Controls_i + \epsilon_i. \end{aligned}$$

	Dependent Variable: Overdue Indicator						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
MoreFamily	-0.038***		-0.005	-0.020	-0.009	-0.027*	-0.024
	(-3.67)		(-0.38)	(-0.36)	(-0.26)	(-1.78)	(-1.09)
Shame		-0.116***	-0.051***	-0.236***	-0.146***	-0.020	-0.175***
		(-11.77)	(-3.29)	(-3.24)	(-3.30)	(-1.13)	(-5.36)
MoreFamily*Shame			-0.119***	-0.670***	-0.392***	-0.015	-0.088**
			(-5.94)	(-6.39)	(-6.32)	(-0.53)	(-2.46)
Constant	0.482***	0.468***	0.485***	0.008	-0.024	0.504***	0.398**
	(-4.64)	(-4.54)	(-4.70)	(-0.02)	(-0.08)	(-3.62)	(-2.53)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Method	OLS	OLS	OLS	Logit	Probit	OLS	OLS
Sample	Full	Full	Full	Full	Full	Male	Female
N	9,380	9,380	9,380	9,380	9,380	5,469	3,911

Expectation and financial incentives

- The expected reward or punishment size is proportional to the interest rate and the *expected* credit needs from the FinTech platform in the future. However, the latter is **unobservable**.

- To proxy the size of expected credit needs, we consider past borrowing incidences, past borrowing amount, and current loan amount because these variables capture borrowers' financial needs and reliance on the FinTech platform.

- If borrowers respond to the size of financial incentives, then *for two hypothetical borrowers with identical characteristics but placed in the Baseline and Reward/Punishment*, the gap in the overdue probability between them widens as their interest rate or credit needs from the platform increase.

- Precisely, we compare the overdue choice in the two financial incentive treatments with those in the Baseline and Reminder, controlling for the level of (expected) size of financial incentives.

	Dependent Variable: Overdue Indicator			
Size is:	Loan Interest Rate	Past Borrowing Incidence	Historical Loan Amount	Current Loan Amount
	(1)	(2)	(3)	(4)
Size	0.039**	-0.036**	-0.007	-0.004
	(-2.23)	(-2.15)	(-0.58)	(-0.29)
FinInctv	-0.150***	-0.178***	-0.175***	-0.174***
	(-16.67)	(-13.39)	(-15.26)	(-15.61)
Size*FinInctv	-0.079***	0.020	0.020	0.019
	(-3.86)	(1.19)	(1.24)	(1.17)
Constant	0.572***	0.472***	0.582***	0.582***
	(6.52)	(4.42)	(6.62)	(6.62)
Controls	Yes	Yes	Yes	Yes
Method	OLS	OLS	OLS	OLS
N	11,949	11,949	11,949	11,949

Male

Size is:	Dependent Variable: Overdue Indicator			
	Loan Interest Rate	Past Borrowing Incidence	Historical Loan Amount	Current Loan Amount
	(1)	(2)	(3)	(4)
Size	0.033	-0.020	-0.008	-0.007
	(1.52)	(-0.95)	(-0.51)	(-0.38)
FinInctv	-0.169***	-0.190***	-0.196***	-0.195***
	(-14.80)	(-12.17)	(-13.52)	(-13.85)
Size*FinInctv	-0.068***	0.013	0.027	0.027
	(-2.68)	(0.63)	(1.35)	(1.33)
Constant	0.421***	0.378***	0.432***	0.434***
	(3.76)	(2.85)	(3.86)	(3.88)
Controls	Yes	Yes	Yes	Yes
Method	OLS	OLS	OLS	OLS
N	7,005	7,005	7,005	7,005

Female

Size is:	Dependent Variable: Overdue Indicator			
	Loan Interest Rate	Past Borrowing Incidence	Historical Loan Amount	Current Loan Amount
	(1)	(2)	(3)	(4)
Size	0.049*	-0.056*	-0.008	-0.002
	(1.68)	(-1.92)	(-0.39)	(-0.08)
FinInctv	-0.124***	-0.154***	-0.146***	-0.144***
	(-8.54)	(-6.32)	(-7.82)	(-7.93)
Size*FinInctv	-0.091***	0.019	0.011	0.007
	(-2.64)	(0.65)	(0.40)	(0.25)
Constant	0.638***	0.435**	0.644***	0.641***
	(4.32)	(2.32)	(4.35)	(4.33)
Controls	Yes	Yes	Yes	Yes
Method	OLS	OLS	OLS	OLS
N	4,944	4,944	4,944	4,944

Policy Implications

- **Microfinance in developing and informal economies (Angelucci et al., 2014; Banerjee et al., 2015a,b; Karlan and Zinman, 2010, 2011; de Mel et al., 2008; Tomy and Wittenberg-Moerman, 2023).**

- FinTech loans are found to significantly enhance credit access for underserved populations, with lower transaction costs and less processing time (Bryan et al., 2021; Chava et al., 2021; Fuster et al., 2019).

- However, the relatively high delinquency rate associated with FinTech lending may impede its operation (Augsburg et al., 2015; Bao and Huang, 2021; Kaboski and Townsend, 2012; Meager, 2019).

- To address this challenge, our research proposes low-cost deterrence mechanisms that leverage social and financial incentives to encourage timely repayments. Our findings suggest that similar microfinance companies can use analogous measures to enhance compliance with financial commitments.

Thank You!